PUBLIC ACCEPTANCE OF BEAVERS AND BEAVER DAMAGE

IN WILDLIFE MANAGEMENT UNIT 14 IN DEC REGION 4

By

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STUDY HIGHLIGHTS

Introduction and Methods

In 1986 the beaver occupancy level in Wildlife Management Unit (WMU) 14 in New York State Department of Environmental Conservation (DEC) Administrative Region 4 was estimated to be about 40%. The occupancy level objective for areas of similar habitat in New York State is 30%. The Regional Wildlife Manager became concerned that the limits of beaver acceptance had been surpassed among landowners with beaver sites on their properties and among town highway superintendents after a large number of unsolicited complaints about beaver damage were registered. Although harvest quotas for the 1986-87 beaver trapping season were designed to reduce the beaver population, DEC biologists wanted to determine the levels of acceptance among landowners and highway superintendents, and if necessary, to refine beaver management objectives in WMU 14 to reflect these findings. The purpose of this study was to determine landowners' and town highway superintendents' attitudes about and acceptance of beavers in WMU 14 in Region 4.

A self-administered, mail-back questionnaire was developed and used to survey 457 landowners (72% responded) and all 41 town highway superintendents (78% responded) in the study area. A sample of nonrespondent landowners was contacted via telephone to assess nonresponse bias.

Findings

PART 1: TOWN HIGHWAY SUPERINTENDENTS

Perceptions of Beaver Damage

- During the period 1985-87, 94% of the town highway superintendents experienced damage to roads or other structures as a result of beaver activity within their jurisdictions.
- The most frequent types of damage reported were blocked culverts and flooded roads.

- Considering all types of damage reported, highway superintendents estimated that repair of each incident required an average of nearly 19 work days of effort and $2,500 in materials and labor.

- The total cost of beaver damage to all highway superintendents in the study area was estimated to be about $1,026,000 during 1985-87, or $342,000 per year.

Actions Taken to Prevent Damage

- About 90% of the superintendents took action to prevent beaver damage from recurring, and many took multiple actions.

- Superintendents taking preventive actions reported about 4 damaged sites annually and about $4,645 in annual repair expenses versus 2.7 damaged sites and $525 in annual repair expenses for superintendents not taking preventive actions.

- 55% of those who requested assistance about controlling beaver damage from DEC were satisfied with the response received. Most of those who were dissatisfied believed they received no help from DEC.

- Almost 75% desired assistance from DEC regarding beaver control. The most desirable form of assistance was a cooperative damage control project where DEC provides the materials and the superintendents provide labor and maintenance.

Acceptance of Beaver Damage and Beaver Population Levels

- 60% of those experiencing damage believed the damage was unreasonable.

- 90% reported they either worried about beavers causing damage or believed beavers were a nuisance.

- 91% wanted a decrease in the beaver population.

- Superintendents had somewhat positive beliefs about noneconomic/ nonextractive-use beliefs and economic/extractive-use beliefs but held negative beliefs regarding tolerance of problems associated with beavers.

PART 2: SITE OWNERS

Characteristics of Site Owners and Their Properties

- Overall 53% were accepting of beavers and 47% were nonaccepting.

- 49% were year-round residents, 18% seasonal residents, 7% lived elsewhere but a tenant lived on the property, and 26% indicated that no one lived on the property.

- Year-round residents were less likely to be accepting of beavers than were other types of residents.

- Properties averaged about 156 acres with woodlands ($\bar{x}$=73 acres) and croplands ($\bar{x}$=72 acres) being the 2 largest types of land categories.

- Homesite was the category described most often as both a primary use (63%) and most important use (39%).

- Those who reported growing cash crops as the most important use of their land were less accepting of beavers than site owners reporting other land categories.

Site Owners' Perceptions of Beaver Activity and Damage

- Site owners' perceptions of beaver presence were higher than the occupancy levels estimated by DEC.

- Those who reported evidence of beaver on their properties also reported an average of about 5 acres of land flooded or covered with water annually as a result of beaver activity.

- No relationship was found between years of damage experience and nonacceptance of beavers. However, those who perceived greater amounts of damage tended to be less accepting of beavers.

- Damage to trees (39%) and soil erosion (35%) were the 2 types of damage reported most frequently.

- Overall, the mean dollars-of-damage per incident was estimated to be about $2,650, and mean out-of-pocket expenses for repair or control of damages were about $1,120.

Actions Taken by Site Owners to Control Beaver Damage

- 70% of the site owners experiencing damage took actions to prevent beaver damage from recurring.

- The control actions taken most frequently were contacting DEC for a beaver removal permit (39%) and allowing others to trap beaver (36%).

- Overall, 59% of those who requested assistance from DEC were satisfied with the response received.

- Of those who were dissatisfied with DEC's response, 76% listed no DEC response or action and 21% listed insufficient DEC response as the reason for their dissatisfaction.

Site Owners Damage Control Concerns

- Ponds and wetlands were recognized as being the most likely property categories to be affected by future beaver damage.
- Ponds/wetlands and croplands were identified as the categories for which control of beaver damage was most important.
- Overall, 49% of the site owners indicated they were willing to modify their property to make it "less attractive to beaver."
- Of those who were unwilling to modify their property, 45% indicated that they enjoyed the presence of beaver and the benefits of wetlands created by beaver.

Attitudes About Beavers and Preferences for Future Population Levels

- Over 60% of all site owners indicated one or more potential recreational uses for wetlands created by beavers.
- Most site owners (85%) believed the beaver population in their township had increased over the past three years whereas 9% perceived no change in the population and 6% perceived a decrease.
- A plurality (47%) of site owners wanted the population to remain at its current level; 39% wanted a decrease and 15% wanted an increase.

Conclusions and Management Implications

Almost half of the owners of beaver sites in WMU 14 of Region 4 are nonaccepting of beaver. Most highway superintendents and most nonaccepting site owners desire a reduction in the beaver population. However, the superintendents' and site owners' perceptions of the beaver population apparently does not reflect actual population levels. Fewer site owners reported evidence of beaver on their properties in 1987 than in 1986, nevertheless, site owners perceived a beaver population higher than that estimated by DEC.

These data provide insights into the acceptance or nonacceptance of beavers at this time in WMU 14 in Region 4. Managers must determine if the level of nonacceptance that currently exists in WMU 14 in Region 4 is excessive. A reduction of the beaver population, mitigation of beaver damage, and/or education of the nonaccepting constituencies to increase their appreciation of beavers and wetlands are 3 possible management responses if the level of nonacceptance exceeds management objectives.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

PUBLIC ACCEPTANCE OF BEAVERS AND BEAVER DAMAGE IN WILDLIFE MANAGEMENT UNIT 14 IN DEC REGION 4

INTRODUCTION

Managing beaver (*Castor canadensis*) populations successfully is a complex undertaking for wildlife managers of the New York State Department of Environmental Conservation (DEC). Establishing levels of beaver populations to obtain ecological as well as recreational benefits while minimizing conflicts with human land use interests requires careful management planning. An important component of such planning is managers' understanding of the potential for problems leading to complaints about beaver activities. In many areas, understanding these problems and accounting for them in management plans may influence greatly the attainment of beaver population levels that are biologically and sociologically acceptable.

Studies were conducted in Central New York in DEC's Administrative Region 7 to obtain information regarding human acceptance of beaver and beaver damage (Purdy and Decker 1985, Purdy et al. 1985). Wildlife managers have used this information to make beaver management decisions that better reflect the interests and concerns of individuals affected by beavers. Recently, however, managers recognized that additional information was needed from Wildlife Management Unit (WMU) 14 within DEC Administrative Region 4.

Based in part on the large number of unsolicited complaints about beaver damage, primarily from landowners with beaver sites on their properties and from town highway superintendents, the Regional Wildlife Manager was concerned that the limits of beaver acceptance had been exceeded for those important constituencies. In response, the beaver trapping season in WMU 14 in Region 4 for 1986-1987 was lengthened to reduce the beaver population.

The Regional Wildlife Manager as well as DEC Furbearer Biologists wanted to determine whether beaver management objectives should be refined in WMU 14 in

Region 4 to maintain an appropriate level of acceptance among landowners and highway superintendents. To fine-tune the management objectives, managers needed baseline information from those constituencies regarding their experiences with and acceptance of beavers and beaver damage.

The purpose of this study was to determine landowners' and town highway superintendents' attitudes about and acceptance of beavers in WMU 14 in Region 4. Our objectives were to:

1. Assess landowners' and town highway superintendents' perceptions of the frequency and extent of beaver damage.
2. Identify factors that affect acceptance of beavers by these 2 constituencies.
3. Determine landowners' and highway superintendents' perceptions of existing beaver populations and preferences for future population levels.
4. Assess the implications of current beaver occupancy levels in relation to landowners' and town highway superintendents' acceptance of beavers.

STUDY AREA

WMU 14 in DEC Region 4 encompasses parts of Delaware, Otsego, and Schoharie Counties and approximates the Appalachia East Ecozone in southeastern New York (Figure 1). More than 86,000 people live in this 4,384 km^2 area (Connelly and Brown 1987). The topography is rolling and is characterized by northern hardwood forests intermixed with dairy farms.

Approximately 1,000 sites that have the potential to be occupied by beaver are located within the boundaries of WMU 14 in Region 4. In 1986 aerial survey data from a sample of such "potential" sites indicated that nearly 40% were occupied by beaver (William Sharick, NY State Dep. Env. Cons., pers. comm.), a level of occupancy substantially above the 30% objective of most of the Appalchian Plateau. By mid 1987, aerial surveys indicated that site occupancy by beaver had been lowered to about 32% (William Sharick, NY State Dep. Env. Cons., pers. comm.).

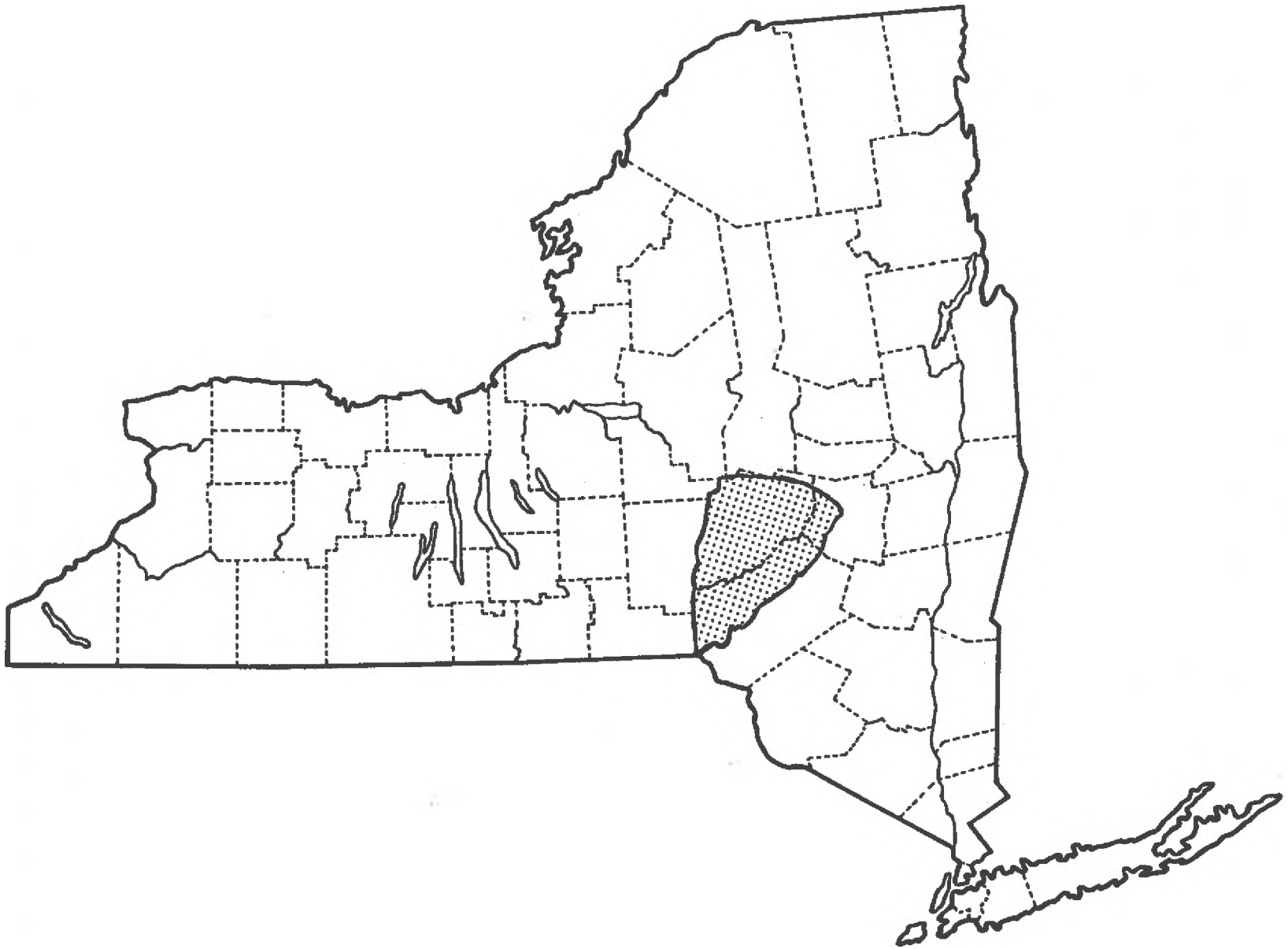

Figure 1. Study area (portion of WMU 14 in Region 4 including parts of Delaware, Otsego, and Schoharie Counties).

STUDY METHODS

Beaver sites in the study area were identified from aerial photographs. Using data from aerial surveys conducted by DEC Region 4 staff in 1986 and records of landowner complaints of beaver damage in the Region, beaver sites were separated into 4 strata for sampling: (1) active sites where landowners had filed complaints of damage (i.e., active - complaint sites), (2) active sites without landowner complaints (i.e., active - noncomplaint sites), (3) sites with no beaver activity observed during aerial surveys (i.e., inactive sites), and (4) sites for which beaver occupancy was uncertain due to the lack of current aerial survey data (i.e., activity - unknown sites). All (n=84) active - complaint sites and all active-noncomplaint sites (n=52) were selected for sampling. In addition, 68 inactive sites and approximately 30% (n=254) of the sites categorized as unknown were selected for sampling, bringing the total sample size to 458. Names and addresses of all property owners (hereafter called site owners) associated with the selected sites were obtained through (a) DEC Bureau of Wildlife listings of wetland landowners, (b) Region 4 beaver nuisance complaint forms and (c) county property tax records. For survey purposes, the site owner on whose property the beaver dam was likely to be located was selected for sites where multiple ownership occurred.

All 41 town highway superintendents in WMU 14 in Region 4 were selected for the survey as well. Names and addresses of superintendents were obtained through the 1987 directory of local roads officials in New York State compiled by the Cornell University Local Roads Program.

Mail questionnaires for both site owners and town highway superintendents were adapted from those used in a similar study of human acceptance of beaver in DEC Region 7 (Purdy and Decker 1985). Surveys were implemented in mid October 1987. Multiple follow-ups were sent to nonrespondents at 7 to 13-day intervals until the end

of November. A follow-up telephone survey was conducted with 54 landowners who did not respond to the mail survey in order to assess possible nonresponse bias.

Statistical analyses were conducted using the Statistical Package for the Social Sciences computer program (SPSS^{x}) (SPSS 1986). Chi-square (X^2) and Student's t statistics were used for group comparisons.

RESULTS AND DISCUSSION

PART 1: Town Highway Superintendents

Useable questionnaires were returned by 32 (78%) of the 41 superintendents surveyed in WMU 14 in Region 4. Due to the large percentage of returns, nonresponse bias was assumed to be negligible.

Recent Beaver Damage

During the 3-year period 1985-87, 94% of the town highway superintendents in WMU 14 within DEC Region 4 experienced damage to roads or other structures as a result of beaver activity within their jurisdictions. Only half as many (48%) of the highway superintendents in Region 7 reported experiencing beaver damage during the 3-year period 1982-84 (Purdy and Decker 1985). However, comparisons should be viewed carefully due to differences in both the study periods and site-occupation rates between the Regions. Most frequently, the types of damage reported in WMU 14 in Region 4 were blocked culverts and flooded roads. The mean number of beaver damage incidents reported annually by superintendents in this study was 3.6 (Appendix A-1). This represents the number of damage incidents not the number of complaints. As Purdy and Decker (1985) reported for Region 7, many incidents apparently did not result in complaints. Still, over two-thirds (69%) of the respondents believed that the number of beaver-related problems had increased over the past 3 years.

Highway superintendents reported that repair of beaver damage required considerable effort and expense (Table 1). Considering all types of damage reported (Appendix A-2), repair of each incident required an average of nearly 19 work-days of effort and $2,500 in materials and labor. These estimates were about one-third more than those reported by superintendents in Region 7 (Purdy and Decker 1985). Repairs to flooded roads in WMU 14 in Region 4 were twice as expensive as blocked culverts but required less than half the time to remedy, possibly reflecting a repair process of relatively short duration yet with large inputs of equipment and materials.

Considering the average of 3.6 damage incidents reported per year and the average repair cost per damage incident, the total cost for repairing beaver damage during the 3-year period 1985-87 for each jurisdiction represented by highway superintendents was estimated to be approximately $27,000. For all superintendents responding to the questionnaire, the total 3-year cost for repairing beaver damage in WMU 14 in Region 4 was about $810,000. If extrapolated to account for non-responding superintendents, the total cost would be nearly $1,026,000 or $342,000 per year. In their recent study in Region 7, Purdy and Decker (1985) estimated that highway superintendents' total cost for repairs of beaver damage during 1982-85 to be only $81,000 or $27,000 per year for the entire 9-county region.

Table 1. Average work-days of effort and repair costs estimated by town highway superintendents per incident of beaver damage reported.

Type of damage	n[1]	Average per incident	
		Work-days	Expenses
Blocked culvert	25	25.8	$1,869
Flooded road	14	9.9	$4,191
Other	4	2.2	$ 562
All types (aggregate)	43	18.4	$2,503

[1]Multiple response possible.

Damage Prevention Efforts and DEC Assistance Desired

Overall, 90% of the superintendents took preventive action to keep beaver damage from recurring and many took multiple actions (Table 2). Nevertheless, fewer than half (47%) conducted regular maintenance at problem sites. Superintendents reporting ≥5 sites having damage problems annually and superintendents with 1-5 years of experience were most likely to take preventive actions (Appendix A-3). Among the most popular types of actions were contacting DEC for damage control information or for a permit to remove beaver (Appendix A-4). To provide DEC with an estimate of the percentage of permits used, we analyzed the methods of beaver removal. Findings showed that up to 62% may have actually used the permit to remove beaver (i.e., 38% removed beaver themselves and 24% contracted someone else to remove the beaver). This is similar to the 58% use found in a survey conducted by DEC Region 4 personnel (William Sharick, NY State Dep. Env. Cons., pers. comm.).

Damage experiences and costs differed between the superintendents who reported taking action to prevent damage from recurring and those who took no such action.

Table 2. Usual actions taken by town highway superintendents in WMU 14 of Region 4 to prevent beaver damage from recurring.[1]

Preventive action	Percent of Superintendents reporting action taken[2] (n=30)
None - just repair damage	10
Contact DEC for beaver control information	37
Contact DEC for beaver removal permit	70
Regular maintenance of problem sites	47
Request DEC to remove beaver	17
Superintendent removes beaver	30
Contract others to remove beaver	23
Modify road/structure design	23

[1]Responses provided by superintendents reporting beaver damage.
[2]Multiple response possible.

Superintendents taking preventive actions appeared to be reacting to relatively heavy damage and large repair costs. They reported about 1 more damaged site annually (3.9 vs. 2.7) and almost 9 times more in repair expenses ($4,645 vs. $525) than superintendents taking no preventive actions.

Superintendents who requested information from DEC to control beaver damage apparently used it to varying degrees. More than half (54%) of the superintendents who requested information from DEC also performed regular maintenance of problem sites, suggesting that the information obtained may have been incorporated into their maintenance practices. However, only 36% of those superintendents who requested beaver control information from DEC also altered the road or other structure design to prevent beaver damage from recurring. Purdy and Decker (1985) found a similarly low percentage (40%) of superintendents in Region 7 who appeared to use information from DEC to modify road design or structure. This may reflect the perceptions of the superintendents that no economically feasible alternatives for road design or structure were available or effective (Ken Griffen, Associate Dir., Cornell University Local Roads Program, pers. comm.).

Satisfaction with DEC Response to Damage Control Requests

Slightly fewer than half (45%) of the superintendents who requested assistance about controlling beaver damage from DEC were dissatisfied with the response received. When asked why DEC's response was unsatisfactory, 17% of the dissatisfied respondents expressed concern over management of the beaver population as indicated by their response "DEC doesn't do enough to prevent beaver overpopulation." The most frequencly listed reason for dissatisfaction (75% of dissatisfied superintendents) was "No help from DEC." One reason for this response may have been the superintendents' lack of awareness of the types of services offered by DEC. If they

were unfamiliar with DEC services, their expectations for action may not have been met.

Although the superintendents' expectations were not examined, their satisfactions relative to requests for 3 types of assistance were analyzed. Of those superintendents requesting a beaver removal permit, 71% were satisfied with DEC's response. About 65% of those requesting general information about beaver control were satisfied with the response received. Satisfaction was also examined for a request of a type of service DEC does not offer; that is, although DEC does not live-trap beavers from problem areas, most (60%) superintendents requesting that type of service were satisfied with DEC's response. These superintendents may have been satisfied with alternatives offered by DEC at the time of their request.

The manner in which superintendents communicated their request for information/assistance[1] was also examined including to whom the request was made and how it was made (Table 3). Satisfaction was highest among superintendents contacting DEC by telephone, especially those who called the Regional DEC office for assistance. In-person requests tended to be made most often to DEC field personnel, and responses to those requests were usually perceived by superintendents to be unsatisfactory. Our data reflect previous research (Purdy and Decker 1985) which indicated that satisfaction differed between those who requested assistance from personnel in the Regional DEC office and those who requested assistance informally through technicians, environmental conservation officers, or other field staff who then

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[1]Manner of communicating the request was assessed by asking superintendents how they requested information/assistance and to whom they made the request. For example, superintendents were asked whether they made the request by telephone, in-person, or in writing. They were also asked whether they made the request to personnel at the Regional DEC offices in Schenectady or Stamford (i.e., office staff) or to DEC staff stationed elsewhere or encountered in the field (i.e., field staff) or to both office and field staff.

relayed the request to the regional office. We have no definitive explanation for why this discrepancy in satisfaction with DEC response occurred.

Superintendents were asked which types of beaver control assistance, if any, they desired from DEC. Almost 75% of the superintendents desired some form of assistance from DEC regarding beaver control. The most popular form of assistance desired (57% of superintendents wanting assistance) was having DEC contribute to cooperative projects to control beaver damage (e.g., DEC provides materials, superintendents provide labor and maintenance). Technical information (e.g., pamphlets), on-site advice about installation of control devices, and technical assistance with design modifications of roads or other structures were each preferred by about 43% of the respondents desiring assistance. In-service training for dealing with beaver damage was least desired by superintendents (22%). However, superintendents may find such training more acceptable if it is coordinated with annual training sessions currently attended by many superintendents and if it is provided for their road crews as well.

Table 3. Town highway superintendents' satisfaction with response by DEC for information/assistance as related to the manner in which the request was communicated.

Satisfied with response	Percent by manner in which the request was made to DEC			
	Overall (n=28)	In-person (n=8)[1]	Telephone (n=24)[1]	Written (n=1)[1]
Yes	55	37	63	0
No	45	63	37	100

[1]n refers to the number of superintendents who contacted DEC in each manner.

Acceptance of Beaver Damage and Beaver Population Levels

Most superintendents (60%) experiencing beaver damage believed the amount of damage was unreasonable. Superintendents were likely to express this perception (i.e., have their capacity for damage acceptance exceeded) as the number of damaged sites experienced annually exceeded 4. Although only 41% of those superintendents experiencing 1-3 damaged sites annually believed the damage was unreasonable, the likelihood of superintendents believing the damage was unreasonable increased over two-fold (i.e., to 85%) as the number of sites damaged in a year exceeded 3. A similar threshold of 4 damaged sites was reported for superintendents in Region 7 (Purdy and Decker 1985).

Superintendents were asked to indicate their preferences for future beaver populations in their jurisdictions so we could assess the influence of their perception of damage on those preferences. Nine out of ten superintendents wanted a decrease in the beaver population; the others wanted the population to remain at its present level. All superintendents experiencing more than 3 damaged sites annually (n=13) desired a decrease in the beaver population. In addition, 14 of 17 superintendents experiencing 1 to 3 damaged sites annually also desired a reduction as did both superintendents who reported that they did not experience any damage sites annually. This indicates that preference for a decrease in the beaver population was not influenced only by the number of damage incidents experienced annually. Other factors such as perceived damage severity and associated repair effort and cost may be influencing superintendents' preferences, as well.

Superintendents' Beliefs Pertaining to Beaver

Purdy and Decker (1985) suggested that highway superintendents' personal feelings about beaver reflected their professional experiences with and acceptance of beaver damage. Results of this study corroborate that analysis. Only 6% of the

superintendents from this study reported they unconditionally enjoyed having beaver in their jurisdictions. About 90% reported they either worried about beaver causing damage or believed beavers were a nuisance. This closely corresponds to the 91% above who wanted a decrease in the beaver population.

A Wildlife Attitudes and Values Scale (WAVS) used in previous studies (e.g., Connelly et al. 1984, Purdy et al. 1984, Smolka et al. 1984, Decker and Gavin 1985, Purdy and Decker 1985) to assess beliefs about uses of wildlife resources was applied in this study of superintendents. Results showed that superintendents had somewhat positive beliefs about both noneconomic/nonextractive[2] and economic/extractive[3] uses of beaver (Figure 2). As would be expected, however, they typically held negative beliefs regarding tolerance of problems[4] associated with beaver. The WAVS reflects that town highway superintendents' feelings about beaver were not uniformly negative. Indeed, the scores indicate that superintendents have many favorable underlying attitudes about beavers. Yet the strength of the negative attitude expressed by problem-tolerance beliefs overrides those positive attitudes and is reflected in their general concerns about beaver damage and their desires for decreased beaver

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[2]**Noneconomic/Nonextractive use beliefs** provide a measure of the human values of beaver that include the importance of talking about beavers with family and friends, observing or photographing beaver, considering the presence of beavers to be a sign of environmental quality, expressing opinions about beaver and their management to public officials or officers of private conservation organizations, enjoyment of knowing that beavers exist in nature, appreciating the role that beavers play in the natural environment, enjoying beavers for their educational value, understanding the reasons that beavers behave as they do, and importance of wetland areas created by beavers.

[3]**Economic/Extractive use beliefs** measure the importance of the values of beaver that include enjoyment of trapping beavers for the sale of furs or pelts, importance of managing beaver for an annual harvest for human use without harming the future of the beaver population, and the benefit to local economies from the sale of equipment, supplies, or services related to trapping beaver.

[4]**Problem-tolerance beliefs** provide a measure of the acceptance of damage or nuisance problems and include willingness to tolerate most beaver nuisance problems, most levels of property damage by beaver, and the ordinary risk of transmitting disease to humans or domestic animals.

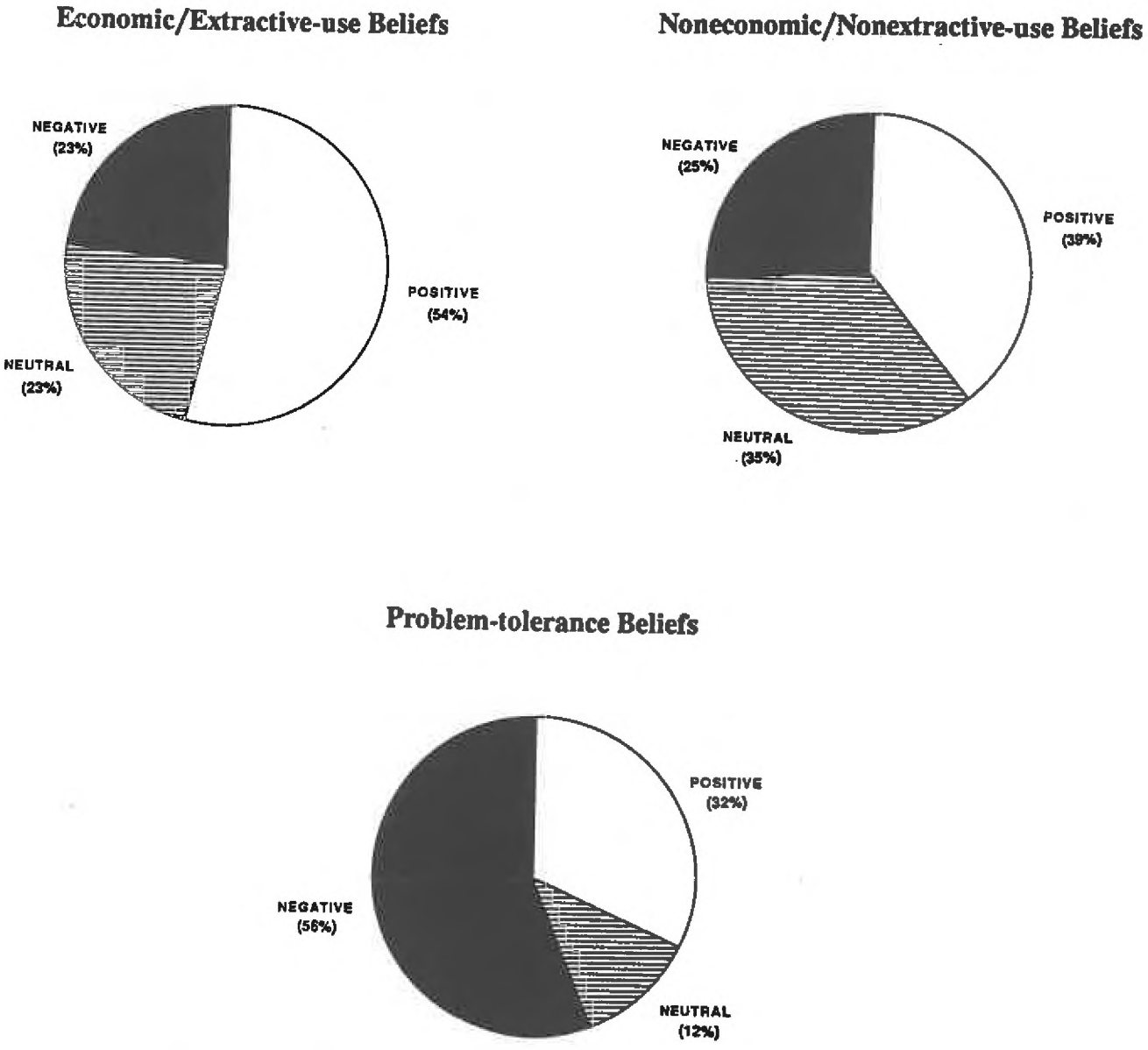

Figure 2. Distribution of town highway superintendents' responses to the 3 dimensions of the Wildlife Attitudes and Values Scale (WAVS). Positive attitudes reflect responses of strongly agree and agree to the WAVS statements. Negative attitudes reflect responses of strongly disagree and disagree.

populations. This suggests that the superintendents inherently liked beavers, but that they could not accept the level of damage beavers were causing.

PART 2: Site Owners

The initial sample size of 457 resulted in 321 codeable returns (72% of the deliverable questionnaires). Response rates among the four sampling strata as classified by the nature of the beaver site located on the site owners' property were: active beaver site with complaint = 78%, active site without complaint = 61%, inactive site = 61%, and site with beaver activity unknown = 70%.

A telephone follow-up survey was conducted with 54 nonresponding site owners. Overall, nonrespondents were generally similar to respondents in their experiences with and attitudes about beavers. The following presentation of results makes note of variables for which significant differences between respondents and nonrespondents were found and discusses any important ramifications for data interpretation.

Data Analysis Design: Development of an Acceptance Typology

A typology that helps to characterize prevailing attitudes of site owners about beaver was developed for this study. Adapted from the design developed by Purdy and Decker (1985), the typology reflects site owners' overall acceptance or nonacceptance of beaver in WMU 14 in Region 4 in 1987.[5] Two questions were used to classify respondents in the typology: (1) "Generally, how do/would you feel about having beaver on your property?"; and (2) "Would you prefer to have beaver populations increased, decreased, or maintained at their current levels in the town

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[5]The terms "acceptance" and "nonacceptance" have been substituted for the "tolerant" and "intolerant" typology categories used by Purdy and Decker (1985). The rationale for considering public acceptance (as opposed to simply tolerance) of wildlife resources is discussed by Decker and Purdy (1988). However, for comparative purposes, we suggest that the typology presented herein be viewed synonymously with that presented by Purdy and Decker (1985).

where your property is located?" The typology indicated that, overall, 53% of the respondents were accepting and 47% were nonaccepting of beaver. We believe this typology will provide a framework for assessing attitudes and related characteristics of site owners that will be useful for managers' evaluation of the impact of beaver population management in WMU 14 in Region 4.

Because site owners' perceptions of beaver activity may be inaccurate, the accepting/nonaccepting typology will provide information more useful than an analysis based on beaver-site classifications. For example, whether or not the owners of a beaver site registered a complaint was not an accurate indicator of the acceptance or nonacceptance of beaver by the site owner (Appendix A-5). Although nearly 80% of the owners of active beaver sites from which a complaint was registered were classified as nonaccepting, 48% of the owners of active beaver sites from which a complaint was not registered were also classified as nonaccepting. In addition, 40% of the owners of inactive beaver sites were also nonaccepting of beaver.

Characteristics of Site Owners and Their Properties

Respondents were predominantly (82%) males ranging in age from 18 to 83 and averaging 53 (Appendix A-6). No difference ($t = -1.36$, d.f. = 268, $P = 0.176$) in age was found between accepting and nonaccepting site owners.

Almost all respondents (98%) resided in rural areas. About half (49%) were year-round residents, 18% seasonal residents, 7% lived elsewhere but a tenant lived on the property, and about one-quarter (26%) indicated that no one lived on the property. Year-round residents were less likely to be accepting of beaver (45%) than were seasonal residents (57%) or site owners who rented to a tenant (55%). Owners of sites on which no one lived were most accepting (65%). These data suggest that site owners who lived off their properties or spent less time on them tended to be more accepting of beaver.

Properties averaged about 156 acres with woodlands (x=73 acres) and croplands x=72 acres) being the two largest types of land categories (Appendix A-7). Over 70% of the site owners reported woodlands, homesites, and wetland areas as characteristics of their properties. Pasture, idle lands, and croplands were reported by about half of the site owners. However, because response was low to this question, these data should not be used for comparison with land characteristics in other geographic locations (e.g., Purdy and Decker 1985).

Homesite was the category described most often as both a primary use (63%) and most important use (41%) (Appendix A-8). No other category was listed as most important by more than one-quarter of the site owners, and fewer than 10% reported cash-crop farming or timber production as the most important use of their land. Site owners who reported that growing cash crops was the most important use of their land were less accepting of beaver than site owners indicating other land categories, whereas acceptance of beaver was prevalent among those site owners reporting timber production or personal recreation as the most important categories. Because cash crops represent the economic livelihood of these site owners, loss of the crops to flooding could be a great economic burden. These site owners had more potential to directly experience beaver activity because they tended to be year-round residents. Site owners reporting timber production or personal recreation as the most important land uses tended not to live on the property year round ($\geq$75% lived there seasonally or reported no one lived on the property) and beaver activity including wetland damming may be compatible with recreational uses of the land.

Site Owner Perceptions of Beaver Activity

Site owners' perceptions of beaver presence were higher than the occupancy level of beavers estimated by DEC managers. More than 60% of the site owners indicated they had observed evidence of beaver activity on their properties in 1986

whereas managers estimated the beaver occupancy level to be 40% (William Sharick, NY State Dep. Env. Cons., pers. comm.). During 1987, when the beaver occupancy level was reduced to 32%, over half of the site owners indicated they had observed evidence of beaver activity on their properties. However, as noted by Purdy and Decker (1985), every respondent's perception of beaver activity may not be accurate, but from a management perspective recognizing that site owners perceived beaver activity on their property is important. Although site owners' perceptions of beaver activity (i.e., occupancy) were higher than that estimated by DEC, site owners' perception of a 12% (i.e., 60% to 53%) decrease in beaver activity from 1986 and 1987 reflected DEC estimates that the beaver occupancy level decreased 20% (i.e., 40% to 32%) during the same time period.

Site owners who reported evidence of beaver on their properties also reported an average of about 5 acres of land flooded or covered with water annually as a result of beaver activity (Table 4). This estimate is half of the size reported by Purdy and Decker (1985) for owners of beaver sites in Region 7. In WMU 14 in Region 4, site owner acceptance was not related to the size of the area flooded by beaver annually ($t = -0.83$, d.f. = 185, $P = 0.407$), but in central New York Purdy and Decker found

Table 4. Number of acres flooded by beaver on site owners' property in an "average year".

	Percent by number of acres flooded						
Site owners	None	≤ 1.0	1.1-4.0	4.1-10.0	>10	Total (n)	Mean acres flooded
All site owners	9	30	30	20	11	100 (199)	4.6
Accepting	59	48	47	44	50		4.3
Nonaccepting	41	52	53	56	50		5.1
Totals (n)	100 (18)	100 (54)	100 (58)	100 (36)	100 (22)		

that nonaccepting site owners experienced about twice as many flooded acres in a year as did accepting site owners. These data indicate that factors other than impact of flooding alone influenced the acceptance of beavers by site owners.

Perceived Quantity and Impact of Beaver Damage

Site owners' experience with beaver damage alone did not dictate whether their overall attitude was accepting or nonaccepting. About 44% of the site owners classified as accepting had previously experienced beaver damage whereas 10% of those classified as nonaccepting had not experienced any damage incidents. Specifically for the years 1986 and 1987, over 70% of accepting site owners experienced beaver damage (Appendix A-9). Indeed, no difference ($t = -1.23$, d.f. = 64, $P = 0.222$) was found between accepting and nonaccepting site owners for the mean number of years in which they had experienced damage since 1986 (1.6 vs. 1.7, respectively). This lack of a relationship between damage experience and nonacceptance of beaver also was observed by Purdy and Decker (1985) in Region 7.

A relationship was apparent, however, between the perceived severity of damage and the degree of acceptance of beaver by site owners; those who perceived greater damage tended to be less accepting of beaver (Figure 3). Results from another measure used in this study supported these findings. About 90% of site owners who reported experiencing severe damage believed that damage to be unreasonable. Conversely, the majority (90%) of persons who perceived light levels of damage believed the damage was tolerable. Those persons who reported moderate damage were more nearly equally split as to whether that damage was tolerable (45%) or unreasonable (55%).

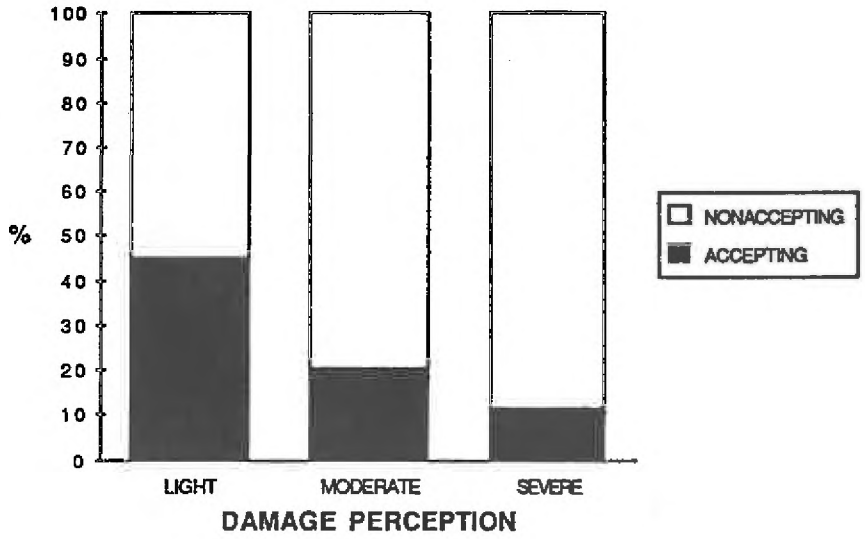


Figure 3. Relationship between site owners' perceptions of beaver damage severity and site owner acceptance of beavers.

Damage Types, Dollars-of-damage Estimates, and Site Owners' Damage-Repair Efforts

Two types of damage accounted for nearly 75% of the damage incidents reported by site owners (Table 5). Damage to trees was reported most frequently (39%) followed by soil erosion (35%). No other type of damage accounted for more than 8% of the damage incidents. Similarly, damage to trees and soil erosion had been indicated as the two most-frequently-occurring types of damage in Region 7 (Purdy and Decker 1985).

Although the types of damage experienced most frequently were the same in this study and that reported by Purdy and Decker (1985), site owners in WMU 14 of Region 4 estimated three and one-half times greater expenses per damage incident than did site owners in the earlier study. Table 5 shows that overall the mean

Table 5. Dollars-of-damage estimates and repair/control efforts by type of damage reported by site owners 1986-1987.

Site owners	All types (n=157)	Trees (n=61)	Soil erosion (n=55)	Structural (n=12)	Crops (n=10)	Blocked culvert (n=8)	Other (n=11)
	Percent by damage type						
	Percent						
Accepting	27	34	20	25	0	38	36
Nonaccepting	73	66	80	75	100	62	64
	100	100	100	100	100	100	100
Aggregate	100	39	35	8	6	5	7
	Mean dollars-of-damage for those with damage						
Accepting	468(16)[1]	606(9)	348(5)	200(1)	0(0)	100(1)	0(0)
Nonaccepting	3,187(55)	1,082(17)	6,226(17)	2,250(6)	659(9)	6,917(3)	3,620(3)
Aggregate	2,651(71)	917(26)	4,890(22)	1,957(1)	659(9)	5,213(4)	3,620(3)
	Mean personal expenses ($) per repair/control for those with damage						
Accepting	268(8)	0(0)	157(3)	550(2)	0(0)	0(0)	190(3)
Nonaccepting	1,363(28)	1,575(4)	1,476(10)	1,575(4)	260(5)	253(3)	4,660(2)
Aggregate	1,120(36)	1,575(4)	1,172(13)	1,233(6)	260(5)	253(3)	1,978(5)

[1]( ) refers to sample size of site owners reporting damage available for calculation of means.

dollars-of-damage was about $2,650 per incident, with blocked culverts and soil erosion being the two most expensive types of damage. Unlike findings in the Region 7 study, site owners with crop damage reported the lowest estimate. This was possibly related to the distribution of crops relative to beaver sites.

The relationship between mean estimated dollars-of-damage and site owners' acceptance or nonacceptance of beaver suggested that nonacceptance of beaver was associated with higher damage estimates. Nonaccepting site owners ($\bar{x}$ = $3,187) experienced significantly more dollars-of-damage than accepting site owners ($\bar{x}$ = $468) ($t = -2.31$, d.f. = 47, $P = 0.026$). Similarly, site owners' out-of-pocket expenses for repairing/controlling beaver damage showed that nonaccepting site owners had significantly greater expenses ($\bar{x}$ = $1,363) than those who were accepting of beaver ($\bar{x}$ = $268) ($t = -1.42$, d.f. = 29, $P = 0.165$).

Purdy and Decker (1985) explored the relationship between mean dollars-of-damage and site owners' acceptance attitudes by categorizing the dollars-of-damage estimates and identifying that category wherein the majority of respondents reporting damage changed from accepting to nonaccepting. In Region 7, this "shift" occurred in the $401 to $500 estimate category. In WMU 14 in Region 4, no "shift" occurred as the majority of respondents reporting damage were unaccepting for all categories of dollars-of-damage estimates. As the Region 7 data indicated, we expected a majority of nonaccepting site owners in the higher dollars-of-damage categories. The higher percentage of nonaccepting site owners in the lower dollars-of-damage categories appeared to indicate that an economic threshold for site owners' acceptance of beavers was far lower than that of site owners in Region 7.

Actions Taken by Site Owners to Control Beaver Damage

Overall, control actions taken by site owners were similar to those reported earlier for Region 7 (Purdy and Decker 1985) although a greater percentage of site

owners experiencing damage in this study took actions (70%). This was likely related to the high estimated cost of the damage as described above. Nonaccepting site owners were more likely to take actions (80%) than were accepting site owners (55%). The control actions taken most frequently by site owners were contacting DEC for a beaver removal permit (40%) and allowing others to trap beaver (36%) (Appendix A-10).

The type of control action taken was apparently related to acceptance of beaver by site owners. Almost all (98%) nonaccepting site owners taking action requested DEC to remove the beaver whereas only about 2% of accepting site owners made such a request. In addition, few accepting site owners removed the beaver by trapping or by other means. These persons more often attempted control without removing the beaver (e.g., removed dam, removed food sources, provided alternate food sources).

Satisfaction with DEC Response to Damage Control Requests

Overall, about 59% of site owners who requested information/assistance from DEC were satisfied with the response. Most accepting site owners (91%) were satisfied compared to half (54%) of the nonaccepting site owners. The percentage of satisfied site owners by request type were: (1) request for control information -- 44%, (2) request for a permit to remove beaver -- 60%, and (3) request that DEC staff remove beaver -- 33%. Only 2 primary reasons for dissatisfaction were listed by site owners; i.e., no DEC response or action (76%) and insufficient DEC response (21%). Similar findings were reported for Region 7 (Purdy and Decker 1985).

As with the superintendents, we analyzed the manner in which site owners' requests were communicated to DEC to determine if there was a relationship between manner of communication and satisfaction with DEC's response. Unlike the superintendents, site owners' satisfaction did not differ among the 3 methods of communication examined: in-person, telephone, and written requests (X^2=0.36, d.f.=2, P=0.850). In addition, accepting and nonaccepting site owners did not differ regarding

from whom they made requests for information/assistance (i.e., office staff or field staff) (X^2=4.98, d.f.=3, P=0.303). However, accepting and nonaccepting site owners differed greatly in their satisfaction with DEC's responses to their requests (X^2=5.40, d.f.=1, P=0.027) (Table 6). Our data suggest that site owners' dissatisfaction may have been due to unrealistic expectations of the types of services that are provided by DEC. For example, almost all unaccepting (and dissatisfied) site owners who requested assistance asked DEC to remove the beaver, yet DEC does not provide this service except in special cases (William Sharick, NY State Dep. Env. Cons., pers. comm.). Apparently, many site owners believe DEC does or should provide this service. Promoting a better understanding and acceptance among site owners of the types of services provided by DEC to site owners may be needed.

Table 6. Site owners' satisfaction with response by DEC for information/assistance as related to site owners' acceptance of beavers.

Satisfied with response	Percent		
	All site owners (n=78)	Accepting site owners (n=11)	Nonaccepting site owners (n=67)
Yes	59	91	54
No	41	9	46
	100	100	100

Site Owners' Beaver Damage Control Concerns

Land categories affected. The land categories that site owners believed most likely to be affected in the event of future beaver damage were diverse (Table 7). In both this study and that reported by Purdy and Decker (1985), slightly more than half of the site owners recognized that ponds and other wetlands were most likely to be affected. The likelihood that other property types would be affected probably was related to the location of those land categories relative to beaver sites. Only 1% of nonaccepting site owners did not know which land categories were likely to be affected, whereas 13% of the accepting site owners said they did not know. This finding again suggests that nonaccepting site owners, possibly through their experiences with beaver, were more aware of how beaver were likely to affect their properties.

A wide range of land categories was also listed when site owners were asked to identify the category for which control of beaver damage was most important (Table 7). Ponds and other wetlands and croplands were the two categories listed most frequently by site owners indicating a category (i.e., did not indicate "none"). About 20% of all site owners (29% of accepting site owners) indicated a lack of concern for control by replying "none" when asked for which land category control would be most important. This compares to 40% in Region 7 where Purdy and Decker (1985) suggested that the greater lack of concern was related to a history of infrequent encounters with beaver and/or nonsevere damage experiences. Our data support that finding.

Willingness to implement beaver control actions. About half (49%) of all site owners indicated they were willing to modify their property to make it "less attractive for beaver" (e.g., habitat modification). Their willingness to do so was related to their concerns about controlling beaver damage. Site owners with the greatest

Table 7. Site owners' reports of land categories likely to be affected by beaver damage and land categories where beaver damage control is most important.

Property type	Land categories likely to be affected — Percent[1]			Land categories where control is most important — Percent[2]		
	All site owners (n=261)	Accepting site owners (n=133)	Nonaccepting site owners (n=128)	All site owners (n=234)	Accepting site owners (n=125)	Nonaccepting site owners (n=109)
Don't know	8	13	1	N/A	N/A	N/A
Homesite	14	11	18	10	9	12
Woodlands	33	28	38	10	11	10
Pasture	37	30	44	10	10	10
Croplands	21	13	28	14	8	22
Ponds/wetlands	55	53	60	15	12	21
Idle fields	29	28	31	2	1	2
Access roads	28	23	37	10	8	15
Recreation site	9	11	7	2	4	0
Other	6	5	7	8	8	4
None	N/A	N/A	N/A	19	29	4
				100	100	100

[1]Percents refer to respondents answering each option affirmatively (multiple response).

[2]Respondents could select only one type (single response).

concerns were the most willing to modify their property. Among nonaccepting site owners, 76% responded affirmatively while only 36% of the accepting site owners indicated they would be willing to modify their property. These findings were consistent with those reported by Purdy and Decker (1985).

Most of the opposition by site owners to property modification was related more to their positive attitudes about beavers and their ponds than to a negative attitude about a specific control approach. About 45% of those unwilling to modify their property indicated that they enjoyed the presence of beavers and the benefits of wetlands created by beavers. About one-quarter of site owners who were unwilling to modify their property were accepting site owners who believed that little or no potential existed for beaver damage on their properties. Very few site owners who were unwilling to modify their property said so because they believed it would be too costly (7%), because they were too busy (4%), or because they did not want to alter their property (8%).

Preferred sources of information about methods to control beaver damage. To reach the greatest number of site owners wanting damage-control information, a multi-media approach may be optimal. When given a choice among several information sources, more than half of all site owners selected DEC's magazine *The Conservationist* (61%) and county Cooperative Extension agents (55%). Obtaining information from a DEC informational pamphlet (48%) and from federal conservation organizations (35%) were also popular. Newspapers (19%), farm organizations (17%), and radio (9%) were preferred the least, indicating that those sources might be least effective. Appendix A-11 shows the information sources preferred by accepting and nonaccepting site owners.

Site Owners' Attitudes and Beliefs About Beavers

A Wildlife Attitudes and Values Scale (WAVS), like that described earlier as part of the survey of town highway superintendents, was employed to determine possible differences among site owners in relation to their beliefs about beaver. As was reported for the superintendents, these beliefs were grouped into 3 categories for analysis: (1) noneconomic/nonextractive-use beliefs, (2) economic/extractive-use beliefs, and (3) problem-tolerance beliefs.

Our findings indicated that our classification of site owners as accepting or nonaccepting was consistent with their basic beliefs about beavers. Responses to noneconomic/nonextractive-use beliefs and especially to problem-tolerance beliefs showed that accepting site owners were much more positive in their feelings about beavers than were nonaccepting site owners (Figure 4). However, it is important to note that although nonaccepting site owners had less positive attitudes about the noneconomic/nonextractive uses of beavers, their feelings toward beavers were not entirely negative. The very negative problem-tolerance beliefs held by nonaccepting site owners were important influences of those site owners' nonacceptance of beavers. Site owners' responses to the economic/extractive-use beliefs suggested a general disagreement by all site owners with such uses, and indeed few reported personally trapping beaver even as a control measure.

Attitudes related to wetland uses. Over 60% of all site owners indicated 1 or more potential recreational uses for wetlands created by beavers. However, only about 40% of the nonaccepting site owners indicated potential recreational uses of those wetlands. As reported earlier, most site owners using their land primarily for recreation were accepting of beavers. About one-quarter of the nonaccepting site owners recognized the nature/wildlife observation potential, and no more than 20% indicated any potential or use for hunting, fishing, or trapping on those wetlands.

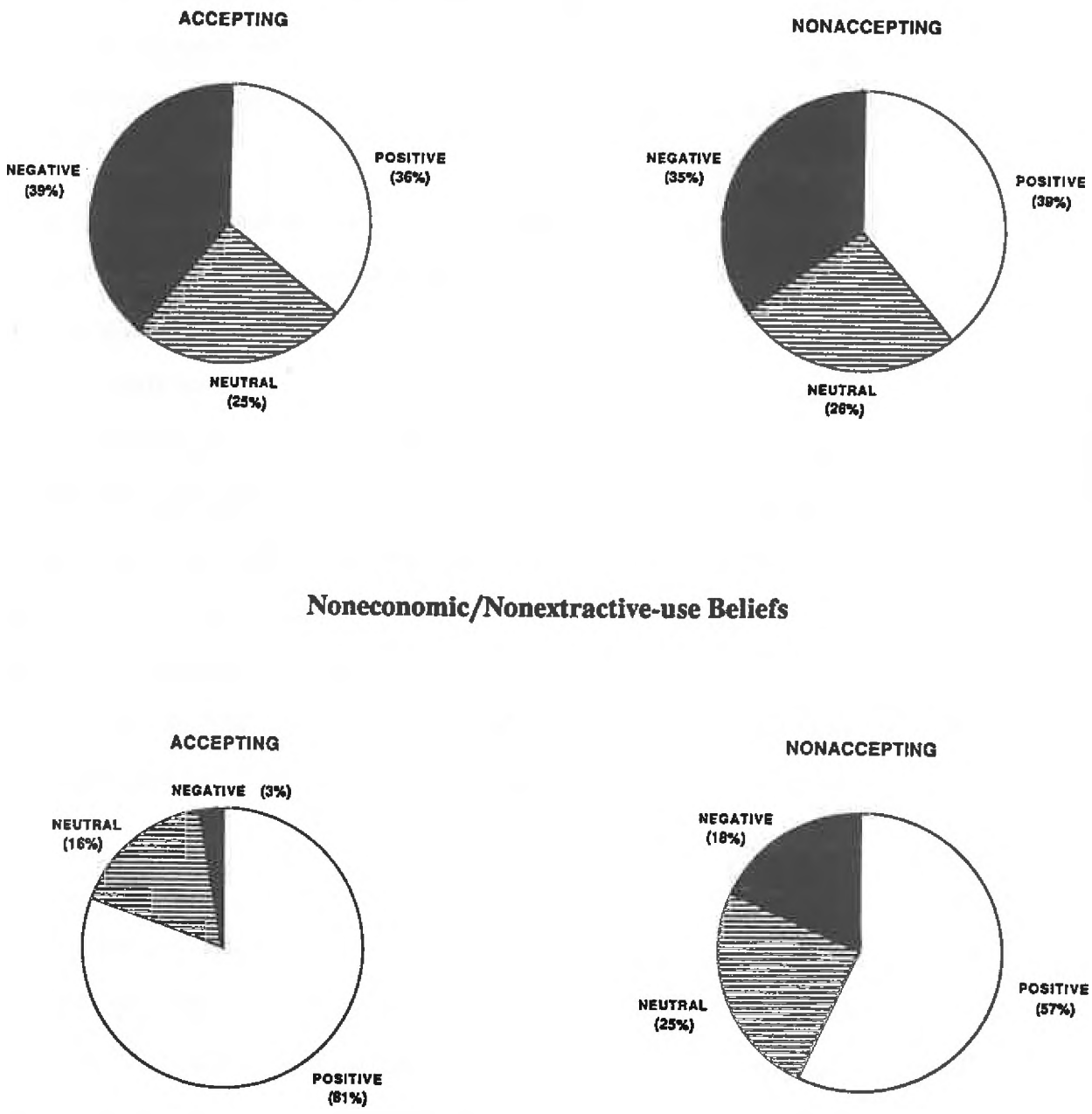
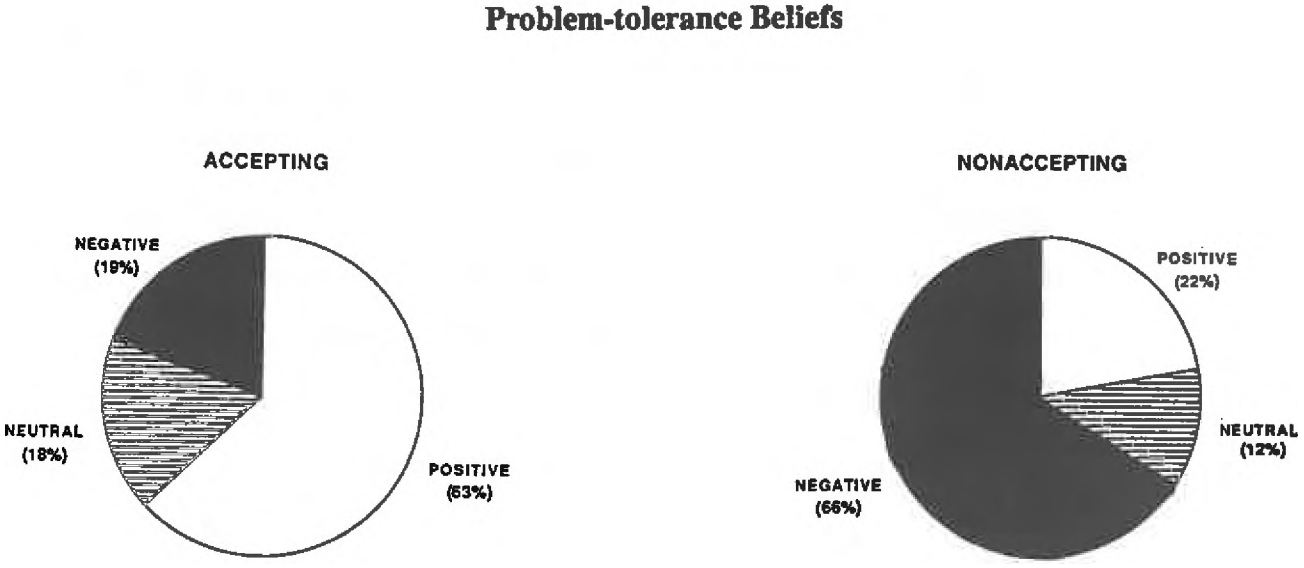


Figure 4. Distribution of site owners' responses to the 3 dimensions of the Wildlife Attitudes and Values Scale (WAVS). Positive attitudes reflect responses of strongly agree and agree to the WAVS statements. Negative attitudes reflect responses of strongly disagree and disagree.

Figure 4 (continued).



Conversely, nature/wildlife observation, fishing, and hunting were recognized as potential recreational uses by 57%, 46%, and 37%, respectively, of the accepting site owners (Appendix A-12).

Perceptions of beaver abundance and preferences for future population levels. Most site owners (85%) believed the beaver population in their township had increased over the past 3 years. Fewer than 10% of all site owners perceived a stable beaver population and fewer still (6%) perceived a decrease in the population despite a recent decrease in beaver occupancy level from 40% to 32% over the last 2 years of the period (William Sharick, NY State Dep. Env. Cons., pers. comm.). However, perceptions of beaver abundance varied greatly between accepting and nonaccepting

site owners. Most (71%) nonaccepting site owners perceived an increase in the beaver population from 1985 through 1987 whereas fewer than 30% of the accepting site owners believed an increase had occurred. In addition, about 19% of the nonaccepting site owners and half of the accepting site owners indicated they did not know how the population had changed. Because the beaver population declined while most site owners believed it had increased, these findings reinforce the importance of knowing site owners' perceptions of beaver populations regardless of the actual population levels. Managers cannot assume the site owners will perceive accurately the results of beaver management programs. (This same kind of discrepancy was discussed by Decker et al. [1983a] relative to farmers' perceptions of deer population trends.)

Overall, most site owners (47%) wanted the beaver population to remain at its current level; 39% wanted a decrease and 15% wanted an increase. As described earlier, site owners' preference for future beaver populations was 1 of 2 questions employed in developing the tolerance typology used in this report. All site owners wanting the beaver population to increase were classified as accepting and all site owners desiring a decreasing population were classified as nonaccepting. Of those desiring no change in the population, 92% were accepting of beaver.

CONCLUSIONS AND MANAGEMENT IMPLICATIONS

Beaver management is a complex undertaking requiring both biological and sociological inputs. The findings provided in this report are intended to help wildlife managers gain a better understanding of some of the human concerns associated with beaver in WMU 14 of Region 4. Many of the findings reported in this study support those of a similar study in Region 7 (Purdy and Decker 1985), indicating the relative consistency of some important relationships. Knowledge of such relationships can be used to refine beaver management programs to maintain beaver population management objectives that are acceptable to the public.

At this point in time, 47% of the landowners with beaver sites located on their properties can be characterized as nonaccepting of beavers. If managers want to reduce this level of nonacceptance (i.e., increase site owner acceptance), they may want to excercise 1 or more potential management strategies. Examples of useful strategies may include reduction of the beaver population, mitigation of beaver damage, and education to increase the key constituencies' appreciation of beavers and wetlands.

The data presented herein also provide an indication of town highway superintendents' and site owners' current perceptions and attitudes about beavers and beaver damage in WMU 14 in Region 4. The relationship of changes in these perceptions and attitudes over time to changes in beaver occupancy level is uncertain. Previous research about farmers' acceptance of deer and deer damage has shown "... the relationships between tolerance change and changes in the deer population and damage estimates are neither constant nor linear" (Decker et al. 1983b: 42). Survey research employing multiple follow-up evaluations would facilitate assessment of whether site owners and highway superintendents become more accepting of beavers

and beaver damage over time even if the beaver occupancy level remains unchanged, or whether other management options are necessary to effect an acceptance change.

The impact of beaver control/damage mitigation measures on human acceptance of beaver has not been fully assessed (Purdy and Decker 1985). However, our findings indicate that the provision of effective damage control information and assistance, especially to those nonaccepting of beaver, may result in a reduction of problems and related damage costs, and thus reduce their level of nonacceptance. Closely related is the issue of site owner satisfaction with DEC response to beaver complaints. Most nonaccepting site owners indicated they were dissatisfied with DEC's response to their complaint of beaver damage. Typically, that dissatisfaction focused on site owners' perception that DEC had not taken sufficient action as a result of the complaints. It is important to note that those who had asked DEC to remove beaver from their properties were least satisfied. Although DEC no longer traps and transfers beavers except in special cases, many highway superintendents and site owners appeared to believe this service is still provided, or should be provided.

Communication between key constituencies and wildlife managers may be ineffective if the constituencies lack an awareness of how to request information/ assistance for control of beaver damage, or if the constituencies have inaccurate expectations of the kinds of responses that will be provided. In this respect, wildlife managers in Region 4 face similar problems as those in Region 7. Programs developed to inform highway superintendents and site owners of the types of services or assistance provided by DEC will enable expectations to be consistent with reality and may improve satisfaction with responses from DEC.

Providing this information to a widely dispersed constituency is often difficult. Findings from this study indicate that a multi-media educational approach may be most successful. In addition, most highway superintendents may be reached through the Local Roads Program sponsored by Cornell University. The Local Roads Program

conducts workshops throughout the state as well as a school for highway officials each spring.

Information programs may have benefits beyond providing technical advice on methods of controlling beaver damage if they also incorporate educational information on the positive values of beavers and the wetlands they create. Although the potential impact of education programs in WMU 14 in Region 4 is uncertain, our data do indicate that town highway superintendents and site owners alike had positive underlying attitudes which could be the foundation for developing greater acceptance of beavers. Survey results further suggest that other programming options might include cooperative projects for control of beaver damage with highway superintendents where DEC provides the materials and highway crews provide labor and maintenance. For private site owners, managers might consider the value of promoting the positive aspects of being a wetlands "owner," or providing incentives for site owners to become "wetlands cooperators" (Purdy and Decker 1985).

The findings reported herein should help managers to integrate better sociological considerations into the beaver management programs of WMU 14 in DEC Region 4. These programs may be focused on population control through regulated harvest, problem mitigation, and increasing human acceptance of beavers. We believe that such an integrated approach would likely reduce the potential for highway superintendents and site owners to become complainants. Understanding the relationships between beaver damage and acceptance of beavers will allow managers to refine management programs and to become less reactive and more proactive by anticipating and addressing the concerns of key constituencies.

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APPENDIX A

Table A-1. Number of sites damaged by beaver in an "average year" reported by town highway superintendents in WMU 14 in Region 4 for the period 1985-87.

Number of damaged sites	Percent of Superintendents (n=32)
0	6
1-2	28
3-5	53
6+	13
Total	100
Mean	3.6

Table A-2. Types of beaver damage typically encountered by town highway superintendents in WMU 14 in Region 4 and those problems perceived to be most important.

	Percent	
Damage type	Typically encountered (n=63)[1]	Most important (n=25)[2]
Blocked culverts	90	64
Flooded roads	70	24
Downed trees in road	20	0
Eroded road	13	8
Blocked drainage ditches	10	0
Damaged bridge	7	4
		100

[1]Multiple response possible.

[2]n refers to number of individuals.

Table A-3. **Relationship between years of occupational experience and usual actions taken by town highway superintendents to prevent beaver damage from recurring.**

Preventive action	Percent by years of experience[1] 1-5 yrs (n=13)	6+ yrs (n=17)	Mean years of experience
None - just repair of damage	23	29	2
Contact DEC for beaver control information	39	35	7
Contact DEC for beaver removal permit	69	71	8
Regular maintenance of problem sites	54	41	6
Request DEC to remove beaver	31	6	4
Superintendent removes beaver	23	35	9
Contract others to remove beaver	23	24	9
Modify road/structure design	23	24	8

[1] Multiple response possible.

Table A-4. **Relationship between the mean number of damaged sites experienced annually by town highway superintendents and the usual actions taken to prevent damage.**

Preventive Action	Percent by number of sites damaged in "an average year"[1]			Mean number of sites damaged
	1-2 (n=9)	3-4 (n=14)	5+ (n=7)	
None - just repair of damage	11	14	0	3
Contact DEC for beaver control information	22	43	43	5
Contact DEC for beaver removal permit	67	71	71	4
Regular maintenance of problem sites	44	43	57	4
Request DEC to remove beaver	22	14	14	4
Superintendent removes beaver	33	36	14	4
Contract others to remove beaver	33	21	14	3
Modify road/structure design	44	0	43	4

[1] Multiple response possible.

Table A-5. Percentages of site owners from each sampling strata included in the typology of beaver acceptance.

Acceptance types	Percent				
	All site owners (n=280)	Active with complaint site owners (n=61)	Active without complaint site owners (n=29)	Inactive site owners (n=42)	Unknown site owners (n=148)
Accepting	53	21	52	60	64
Nonaccepting	47	79	48	40	36
	100	100	100	100	100

Table A-6. Age distribution of site owners surveyed by acceptance typology.

Years of age	Percent		
	All site owners (n=306)	Accepting site owners (n=146)	Nonaccepting site owners (n=124)
Under 35	11	13	8
35-45	22	24	20
46-55	24	22	27
56-65	23	23	24
Over 65	20	18	21
Totals	100.0	100.0	100.0
Mean age	52.3	51.2	53.5

Table A-7. Frequency of occurrence and average size of land categories of site owners' properties.[1]

Land use	All site owners (n=280)		Accepting site owners (n=148)		Nonaccepting site owners (n=132)	
	%[2]	x[3]	%	x	%	x
Homesite	73	5.0	71	4.5	75	5.6
Woodlands	79	73.4	79	77.1	78	69.2
Pasture	54	46.9	53	44.6	55	49.5
Croplands	45	72.3	42	67.6	48	76.9
Ponds, streams, or marsh	72	14.0	72	14.7	72	13.3
Idle fields	46	27.4	49	32.7	43	20.7
Mean total acres		155.6		157.7		153.1

[1]Sample sizes reflect only those respondents who could be classified in the typology. In addition, these data represent a low percentage of the possible number of responding site owners because of low response to the particular question that solicited these data.

[2]Multiple response possible.

[3]Average acres of land use for properties on which they occur.

Table A-8. Comparison by type of site owner of most important land categories on site owners' properties.

Site owners		Land category: Homesite	Farm cash crop	Farm livestock	Timber	Private recreation	Total
All	PI[1]	63	24	29	32	51	N/A
(n=201)	MI[2]	41	8	22	6	23	100
		MI (n=79)	MI (n=14)	MI (n=41)	MI (n=12)	MI (n=42)	
Accepting		52	36	49	67	69	
Nonaccepting		48	64	51	33	31	
Total		100	100	100	100	100	

[1]Percent of respondents indicating this land use was a primary use of property (a property may have more than one type of primary use).

[2]Percent of respondents indicating this land use was the single most important land use of the property.

Table A-9. Years in which site owners experienced beaver damage or nuisance problems.

Year of damage	Percent [1]		
	All site owners (n=302)	Accepting site owners (n=100)	Nonaccepting site owners (n=107)
Any previous year[2]	69	44	90
1986[3]	90	86	92
1987[3]	74	71	78
Mean years of damage	1.6	1.6	1.7

[1]Multiple response possible.

[2]Percent of all respondents reporting damage.

[3]Percent of respondents reporting damage in a specific year; applies only to respondents with previous damage.

Table A-10. Actions taken by site owners to control beaver damage.

Action taken	Percent[1]		
	All site owners (n=135)	Accepting site owners (n=42)	Nonaccepting site owners (n=93)
None	30	45	20
Contacted DEC for control information	31	14	41
Contacted DEC for removal permit	40	14	54
Requested DEC to remove beaver	29	2	98
Personally trapped beaver	6	7	7
Others trapped beaver	36	17	45
Removed beaver - not by trapping	19	5	26
Attempted control without moving beaver	25	38	18
Other	10	12	11

[1]Multiple response possible.

Table A-11. Sources most preferred by site owners for obtaining information regarding control of beaver damage.

Information Source	Percent[1]		
	All site owners (n=262)	Accepting site owners (n=142)	Nonaccepting site owners (n=120)
Cooperative Extension agent	55	51	58
DEC *Conservationist*	61	63	58
DEC pamphlet	48	51	42
Farm organization (e.g., Grange, farm bureau)	17	18	14
Federal conservation organization (e.g., ASCS, SCS)	35	37	31
Newspaper	19	19	22
Radio	9	9	12
Other	5	7	2

[1]Multiple response possible.

Table A-12. Site owners' recreational uses of wetlands created by beaver on their property.

Recreational use	Percent[1]		
	All site owners (n=270)	Accepting site owners (n=145)	Nonaccepting site owners (n=125)
None	38	21	58
Nature/wildlife observation	43	57	25
Fishing	33	46	19
Trapping	18	23	14
Hunting	28	37	20
Other	5	8	0

[1]Multiple response possible.